

PATENT ABSTRACTS OF JAPAN

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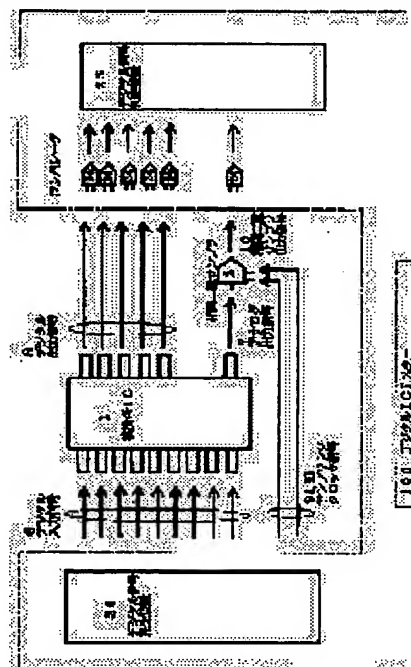
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(54) APPARATUS AND METHOD FOR INSPECTING DIGITAL-ANALOG HYBRID IC

(57)Abstract:

PROBLEM TO BE SOLVED: To reduce cost and the time taken for tests.

SOLUTION: This apparatus for inspecting a digital-analog hybrid IC providing digital signal outputs and analog signal outputs comprises a means 24 for comparing a signal inputted to an input terminal with a reference value and a means 25 for determining the quality of the signal, based on the compared result by the comparing means. A digital signal from the digital-analog hybrid IC 1 is inputted directly to the input terminal of the comparing means and an analog signal from the digital-analog hybrid IC 1 is inputted to the input terminal of the comparing means through a correlation double sampling means 2.



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10 [Claim(s)]

[Claim 1] It is test equipment of a digital-analog integrated circuit which performs a digital signal output and an analog signal output which is equipped with the following, carries out the direct input of the digital signal output from a digital-analog integrated circuit to an input terminal of said
15 comparison means, and is characterized by coming to input an analog signal output from this digital-analog integrated circuit into an input terminal of said comparison means through a correlation duplex sampling means. A comparison means to compare with a reference value a signal inputted into an input terminal A judgment means to perform a quality judging of this
20 signal based on a comparison result by this comparison means

[Claim 2] Said correlation duplex sampling means is test equipment of a digital-analog integrated circuit according to claim 1 characterized by outputting a change value between change before of said analog signal output, and the change back.

25 [Claim 3] An inspection method of a digital-analog integrated circuit characterized by detecting a change value between change before of an analog signal output from said digital-analog integrated circuit, and the change back,

comparing this change value and reference value in an inspection method of a digital-analog integrated circuit which performs a digital signal output and an analog signal output, and performing a quality judging of an analog signal based on this comparison result.

5 [Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] This invention relates to the test equipment and its inspection method of a digital-analog integrated circuit.

10 [0002]

[Description of the Prior Art] In order to inspect IC components, a predetermined signal is inputted to inspected components (DUT), and the signal outputted from DUT in that case is compared with expected value. In digital one / analog mixture IC, conducting both digital output inspection by the digital comparator and analog output inspection by the A/D converter is called for especially. In order to realize this, conventionally, it inspected with two equipments, a digital IC circuit tester and an analog IC circuit tester, or was inspecting using large-scale digital one / analog mixture IC circuit tester.

15 [0003] Drawing 3 shows the rough block diagram of test equipment with digital one / analog mixture IC circuit tester 101 to which it is carried out conventionally. The checking digital signal 6 is inputted into inspected [IC / 1] with the digital signal generator 26, and after evaluating the analog signal 7 outputted in that case by A/D converter 21, it stores in the capture memory 22. Then, when the processor 23 for an operation calculates the data
20 stored in the capture memory 22, a parameter required for evaluation of an analog output property inspected [IC / 1] is computed, and a quality judging is performed. Furthermore, also with the digital output signal 8 inspected
25

[IC / 1], after digitizing to '0' or '1' with a comparator 24, as compared with the value expected as an excellent article, a quality judging is performed with digital signal judging equipment 25.

[0004] thus -- a Prior art -- a digital output and each analog output --
5 inspection of DEJIROGU / analog mixture IC is realized by inspecting using a separate unit.

[0005]

[Problem(s) to be Solved by the Invention] The above-mentioned conventional example is applicable to inspection of digital one / analog mixture IC
10 components of many classes. However, in IC by which the digital signal terminal built a small number of analog signal terminal into the inside which is seen by Microcomputer IC, a graphic controller IC, etc. with a built-in analog output port, and which occupies the most like having increased in recent years, and inspecting such an IC, the following technical problems
15 occurred.

[0006] (1) Since it is necessary to use large-scale digital one / analog mixture IC circuit tester which had capture memory and a processor for an operation as test equipment for analog output inspection, the cost which inspection takes will become high.

20 [0007] (2) Since it is necessary to perform the operation by the processor in case the quality judging of an analog output signal is performed, the time amount concerning inspection will become long.

[0008] The purpose of this invention is by realizing a test with the common digital IC circuit tester which does not use an analog measurement unit to IC
25 components equipped with the digital-input/output terminal and the analog output terminal to reduce the cost concerning a test, and time amount.

[0009]

[Means for Solving the Problem] Test equipment of a digital-analog integrated circuit of this invention In test equipment of a digital-analog integrated circuit which performs a digital signal output and an analog signal output It has a comparison means to compare with a reference value a signal inputted into an input terminal, and a judgment means to perform a quality judging of this signal based on a comparison result by this comparison means. The direct input of the digital signal output from a digital-analog integrated circuit is carried out to an input terminal of said comparison means, and it is characterized by coming to input an analog signal output from this digital-analog integrated circuit into an input terminal of said comparison means through a correlation duplex sampling means.

[0010] In an inspection method of a digital-analog integrated circuit which performs a digital signal output and an analog signal output, an inspection method of a digital-analog integrated circuit of this invention detects a change value between change before of an analog signal output from said digital-analog integrated circuit, and the change back, compares this change value and reference value, and is characterized by performing a quality judging of an analog signal based on this comparison result.

[0011] The analog signal output having a digital signal output / analog signal output inspected [IC] inputs into a correlation duplex sampling means, and it carries out inspecting whether it is a comparison means, it is comparing an output and a reference value from a correlation duplex sampling means, and the voltage value-change width of face outputted from an analog signal output inspected [IC] corresponding to various input signals is a value within a reference value as it is possible, and above-mentioned this invention carries out the quality judging of IC components.

[0012] Since an analog signal output can be inspected using a comparison

means and a judgment means of inspecting a digital signal output in this invention, capture memory, a processor for an operation, etc. become unnecessary, a configuration of equipment is simplified, and time amount concerning inspection is also shortened.

5 [0013]

[Example] Hereafter, the example of this invention is explained to details using a drawing.

[0014] Drawing 1 is the rough block diagram showing the test equipment of digital one / analog mixture IC by this invention. In addition, it is ** which
10 attaches the same sign about the same configuration member as the configuration member of drawing 3.

[0015] As inspected [IC / 1], digital one / analog mixture IC which built in the terminal which outputs the analog signal of the voltage value which changes gradually according to a digital input signal are assumed, for
15 example like the DAC built-in graphic controller IC. In order to judge the quality measured [this / IC / 1], while checking that the digital output signal 8 is as expected value corresponding to the digital input signal 6 which changes variously, checking that the voltage change value of the analog output signal 7 is in a regular precision is also called for.

20 [0016] However, since the judgment with expected value (reference value) is performed after making an output signal inspected [IC / 1] binary to '1' or '0' with a comparator 24, the common digital IC circuit tester 100 cannot measure the voltage change value of the analog output signal 7, if it remains as it is.

25 [0017] So, in this invention, it made it possible to compare the voltage change value of the analog output signal 7 corresponding to change of an input signal 6 with a comparator 24 on real time by inserting the correlation duplex

sampler 2 between the analog output signal 7 and a comparator 24, and sampling with the sampling clock signal 9 which synchronized with the digital input signal 6. After digitizing to '0' or '1' with a comparator 24, digital signal judging equipment 25 performs a quality judging as compared with the value expected as an excellent article.

[0018] Drawing 2 is the wave form chart showing the example of a wave for testing the differential linearity precision of a D/A converter by the above-mentioned system. Digital signals 6 are N, N+1, N+2, and a signal that makes order generate the voltage of -- which becomes high gradually to the analog output signal 7. It is the purpose of this inspection to check that change width-of-face ΔV_n (ΔV_1 , ΔV_2 , ΔV_3 , ΔV_4 , ΔV_5 , ΔV_6 , ...) of the analog output signal 7 in each of this phase is always settled in the value of convention within the limits. Then, it changes into the voltage value on the basis of GND level by processing the analog output signal 7 with a correlation duplex sampler. What is indicated by JP,7-107391,A etc. can be used as a correlation duplex sampler. The configuration and function output the change value of the input signal 7 at the time of the standup of sampling clock 9A, and the standup of sampling clock 9B on the basis of GND level as they are shown in drawing 4 and drawing 5. Just before [at the time of change of the analog output (input to correlation duplex sampler) signal 7 inspected / IC] as shown in drawing 2 therefore, the standup of sampling clock signal 9A Moreover, by synchronizing the standup of 9B with immediately after [at the time of change], it becomes possible to make the output signal 10 of a correlation duplex sampler generate change value ΔV_n of an analog signal 7. By comparing this with a value of standard with the comparator 24 which the digital IC circuit tester 100 has, it becomes possible to inspect the precision of

the voltage change value of the analog output signal 7 measured [IC].

[0019]

[Effect of the Invention] As explained above, in case digital one / analog mixture IC is inspected according to this invention, it becomes possible to

5 carry out using comparison means, such as a digital IC circuit tester's comparator, also with inspection of not only a digital output terminal but an analog output terminal, and the time amount and cost which a test takes can be reduced.

[Brief Description of the Drawings]

10 [Drawing 1] It is drawing showing the example of test equipment of digital one / analog mixture IC by this invention.

[Drawing 2] It is drawing showing the example of a wave at the time of digital one / analog mixture IC inspection by this invention.

15 [Drawing 3] It is drawing showing the example of test equipment of conventional digital one / analog mixture IC.

[Drawing 4] It is drawing showing the configuration of a correlation duplex sampler.

[Drawing 5] It is drawing showing functional actuation of a correlation duplex sampler.

20 [Description of Notations]

1 Inspected [IC]

2 Correlation Duplex Sampler

6 Digital Input Signal Inspected [IC]

7 Analog Signal Which Inspected [IC] Generates

25 8 Digital Signal Which Inspected [IC] Generates

9A, 9B Clock signal for a correlation duplex sample

10 Output Signal of Correlation Duplex Sampler

21 IC Circuit Tester's A/D Converter

22 IC Circuit Tester's Capture Memory

23 IC Circuit Tester's Processor for Operation / Judgment

24 IC Circuit Tester's Comparator

5 25 IC Circuit Tester's Digital Signal Judging Equipment

26 IC Circuit Tester's Digital Signal Generator

100 Digital IC Circuit Tester

101 Digital One / Analog Mixture IC Circuit Tester

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